### Macquarie University Macquarie University Central Courtyard Precinct

Integrated Water Management Plan

S\_0-INFR-CV-RP-103

Issue 2 | 24 May 2018

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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## **Document Verification**

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# 1 Introduction

This report supports a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment (DP&E) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Macquarie University (MU) is seeking development consent for the first phase of the Macquarie University Central Courtyard Precinct (MUCCP) redevelopment. Under this application, consent is sought for redevelopment of Building C10A, construction of two student accommodation buildings (Buildings R1 and R2) and redevelopment of the landscaped Central Courtyard.

This report summarises the water management strategy that has been an integral consideration of the design of the proposed development. Key objectives of this plan include the minimisation of potable water demand particularly through deployment of rainwater harvesting and reuse and the incorporation of water sensitive urban design elements in landscaped areas to improve water quality.

### 1.1 **Project Description**

#### 1.1.1 Background

MU is a teaching and research institution of international, national and state significance. It is ranked among the top two per cent of universities in the world and holds a 5-star QS rating. MU is renowned for its innovative research and its commercial partnerships, with more than 100 leading companies located on Campus or in the surrounding Macquarie Park high-tech precinct.

The University was founded in 1964 and has since grown into a large research university with over 30,000 students and 3,000 staff. More than \$1 billion has recently been invested in MU facilities and infrastructure to ensure students and staff can thrive in an inspiring and technologically advanced learning environment.

In March 2014, MU adopted the 'Macquarie University Campus Master Plan 2014'. The Master Plan builds on the approved MU Concept Plan 2009 and sets out the physical framework to accommodate the University's predicted needs, while ensuring flexibility into the future and enhancing the existing qualities of the University's campus. Ongoing changes in teaching methodologies, new course opportunities, a desire to increase industry engagement and the potential for commercial opportunities on the Campus were all key considerations in the development of the Master Plan.

#### **1.1.2** Site Description

The MUCCP is situated in the centre of the University campus, within Precinct A. The MUCCP currently contains Buildings C9A and C10A (the Student Hub) which are subject to a separate demolition DA to City of Ryde Council, Buildings C8A, C7A and the landscaped Central Courtyard. The MUCCP is a key component of the University campus.

Figure 1 shows the location of the MUCCP within the context of the University campus.



Figure 1. Location of the site in the context of the existing Macquarie University campus

#### **1.1.3** Overview of the Proposed Development

In accordance with the Master Plan, MU has identified the opportunity to move student accommodation to the heart of the campus. The Master Plan also acknowledges the importance of the MUCCP, and the need to retain the Precinct as a key focus of the University's civic and administrative functions, with active edges for retail, and food and beverage uses.

MU is seeking to secure development consent for the first phase of the MUCC precinct redevelopment. Consent is sought for redevelopment of Building C10A (known as 1 Central Courtyard), construction of two student accommodation buildings (R1 and R2) and redevelopment of the landscaped Central Courtyard. The proposal comprises:

• Construction of a new, multi-storey Student Hub (1 Central Courtyard) in place of existing Building C10A, with ancillary retail uses.

- Construction of two student accommodation buildings (Building R1 and R2) to provide approximately 340 student beds and integrated academic uses.
- Redevelopment of the landscaped Central Courtyard.
- Construction of a shared basement including plant, loading and waste management facilities, end of trip facilities and accessible parking.
- Installation of a new substation.
- Installation of utilities and services to accommodate the proposed development.
- Upgrade of the western extent of Science Road to accommodate fire brigade access.
- Tree removal and landscaping.

The extent of the SSDA works is shown in Figure 2.



Figure 2. Extent of the MUCCP SSDA

#### **1.2** Scope of this Report

This report has been prepared to describe and document Arup's proposed integrated water management plan for the MUCCP development. The preparation of this strategy has involved several interdependent technical considerations as follows:

- Proposed water supplies to buildings and external areas
- Opportunities for rainwater harvesting and re-use infrastructure

- Proposed end uses of potable and non-potable water
- Stormwater quality and Water Sensitive Urban Design (WSUD)

#### **1.3** Planning and Design Objectives

This primary objective of this report is to articulate the basis of the proposed integrated water management strategy and to demonstrate how stormwater quality will be managed and integrated into the precinct to the satisfaction of Macquarie University, NSW Department of Planning and all associated stakeholders to which this planning application will be referred.

This includes the design requirements of the Local Government Area (LGA) -City of Ryde Council's Development Control Plan (DCP 2014) and Environmental Planning and Assessment Regulation 2000.

The integrated water management plan aims to achieve the following:

- To provide commentary on and design direction for the proposed development infrastructure which will provide collection, treatment and harvesting and/or discharge of rainfall within the precinct
- To capitalise on opportunities for rainwater harvesting and reduce the precinct's potable water demands in keeping with the sustainability drivers adopted as part of this development
- To deliver good water quality outcomes through the integration of soft landscaping and treatment technologies in keeping with the principles of Water Sensitive Urban Design (WSUD)

## 2 **Potable water consumption**

The potable water reduction strategy is implemented through the installation of efficient fixtures, recycling water and monitoring water use:

- Rainwater harvesting and reuse will be key to reducing potable water demand. A proposed strategy is for roofwater from buildings C10A, R1 and R2 to be captured into a centralised tank. This will become a source non-potable water for cooling towers located on the roof of C10A.
- All fixtures and fittings will target fixture ratings within one star of the highest rating (5A) based on the Water Efficiency Labelling and Standards (WELS) scheme.
- Where potable water is used for irrigation Arup recommend drip irrigation with a moisture sensor override to mitigate unnecessary watering.
- All areas of major water use will be logged via a BMS to monitor water consumption in keeping with the University's existing approach to monitoring. This will permit a detailed understanding of water consumption over time and inform any future initiatives to further reduce water consumption.
- The fire protection system will include provisions to reduce test water discharge by 80%. This will include recirculating pump test water and the installation of zone-check devices for flow switch testing.

# 3 Rainwater Harvesting

The development is to be provided with a rainwater harvesting system to supply non-potable water to the buildings. Rainwater will be captured from the roof of C10A, R1 and R2 via a siphonic stormwater system and discharged into an inground precinct rainwater tank located within the Central Courtyard. The rainwater is used to supply the precinct cooling towers located within C10A and some limited irrigation of the courtyard and building landscaping areas.



Figure 3. Precinct rainwater harvesting system

Rainfall from approximately 7,200  $\text{m}^2$  of roof area will be capture from C10A and the residential buildings. A water balance study was conducted for the precinct and a 180 kL tank will be installed to maximise rainwater capture. The rainwater harvesting system is estimated to provide approximately 11% potable water saving.

The non-potable water supply will include pre-treatment via automatic backwash filtration prior to supply to cooling towers and irrigation to maintain water quality. The cooling towers are expected to utilise approximately 90% of the total non-potable water harvested with the remaining 10% supplied to irrigation.

In the event of significant stormflows, overflow from the rainwater tank will discharge into civil stormwater infrastructure to permit safe management of this water to downstream areas (refer to the Stormwater Management Strategy Planning Submission – SSDA report [S\_0-INFR-CV-RP-101]).

# 4 Water Sensitive Urban Design (WSUD)

Integrated water sensitive urban design (WSUD) measures can provide positive visual, water quality and public amenity benefits to a site. The preliminary landscape design for the MUCCP includes numerous WSUD features in addition to the proposed rainwater harvesting and reuse strategy discussed in Section 3.

The WSUD strategy has been developed based on current best practice, taking guidance from the City of Ryde Water Sensitive Urban Design Guidelines (2015), Water Sensitive Urban Design Technical Guidelines for Western Sydney (UPRCT 2004) and Evaluating Options for Water Sensitive Urban Design (JSCWSC, 2009) documents.

Drawing upon this guidance, the proposed WSUD strategies will be arranged to manage rainfall and runoff from the precinct as a whole and where possible be seamlessly incorporated in the design of landscaped areas. Key features will include:

- Pollutant filter baskets and gross pollutant traps will be strategically positioned to capture gross pollutants and suspended solids. This will provide primary treatment of runoff from hard paved areas including the central courtyard and residential courtyard areas
- Use of grass swales to landscaped area to drain surface flows such as adjacent to the graduation stairs to the east of C10A. This removes gross pollutants and large sediment particles
- Maximised pervious areas in landscaped areas which will be serviced by passive irrigation using rainfall runoff from adjacent impervious areas wherever possible. This runoff will be encouraged to collect in planted areas and thereby infiltrate soil layers to water root systems. Water that exceeds the vegetation uptake will percolate through to the deeper layers of the planted areas and ultimately be collected into subsoil drains to prevent water logging. This filtration process removes pollutants, reduces potable water demand and also attenuates peak stormwater runoff from the site.
- Bioretention rain gardens treating runoff from the residential courtyard area and removing key nutrients such as phosphorus and nitrogen from runoff

Figure 4 illustrates the location of these proposed strategies within the development area. These strategies will interact with each other to create an effective water quality treatment train to minimise pollutant loads discharged to downstream waterways whilst providing habitats for native flora and fauna.



Figure 4 - Opportunities for WSUD within the MUCCP

City of Ryde Council's Water Sensitive Urban Design Guidelines (2015) provide a series of pollutant reduction targets as illustrated in Figure 5. These have been used in assessing the effectiveness of the proposed systems and treatment train as described above. Further detail about the assessment is provided in Arup's Stormwater Management Strategy Planning Submission – SSDA report (S\_0-INFR-CV-RP-101).

Pollutant	City of Ryde requirement (% reduction)
Total Suspended Solids	85
Total Phosphorous	60
Total Nitrogen	45
Goss Pollutants	90

Notwithstanding the numerical assessment results, the principles of the proposed WSUD approach are absolutely in accordance with the recommendations of the City of Ryde Council Guidelines.

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## 5 Conclusion

The philosophy of Integrated Water Management has been incorporated in the design of the proposed MUCCP development precinct. In this respect, the design includes key initiatives such as water efficient fixtures, rainwater harvesting and Water Sensitive Urban Design in order to holistically manage water at the site.

The nature and location of the proposed integrated water management strategies have been described in this report. These strategies will achieve key benefits such as reducing potable water demand, reducing stormwater runoff, improving the stormwater quality and providing aesthetically pleasing landscaped areas which provide habitats for various species.

It is anticipated that these strategies will be developed further at the detailed design stage. This report demonstrates a strong commitment to the implementation of an integrated water management strategy for the precinct, which has informed the design process for the precinct from the outset.